Invertebrata

Tasmania's Invertebrate Newsletter

Inside...

Features:

Articles:

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No. 20

Invertebrata is produced by the Queen Victoria Museum and Art Gallery, Launceston, Tasmania.

We publish articles and short notes on all aspects of invertebrate biology and conservation in Tasmania.

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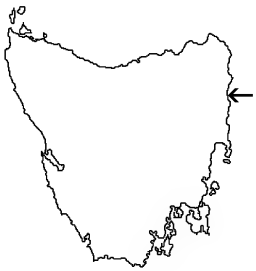
BAD NEWS FROM HENDERSON LAGOON

Henderson Lagoon is an irregularly shaped tidal estuary, shallow and about three kilometres long, which normally opens into the sea just north of Falmouth on Tasmania's East Coast. Occasionally the barway becomes sanded over, impeding the outflow of several creeks which feed the Lagoon, and flooding adjacent farmland.

During the latter half of the 1990s, Henderson Lagoon became the focus of attention of scientists from CSIRO's Marine Research Division. The reason was the introduced European Green Crab, *Carcinus maenas*, which for unknown reasons seemed to be thriving in the Lagoon. However, subsequent field surveys revealed a waxing and waning of Green Crab numbers, adults sometimes disappearing altogether. Researchers realised that to understand what was happening to the population as a whole, younger (post-larval) *C. maenas* would have to be studied.

In addition to standard crab traps for adults, passive benthic collectors were deployed to provide a haven for newly settled juveniles. The collectors were short lengths of PVC pipe, 16 cm in diameter. Each was filled with 'Hogshair', a synthetic fibrous material used in air-conditioner filters, and the collector ends were covered with 6 mm oyster mesh. Suitably weighted, the collectors were placed on the sea bottom at selected sites.



Arrow: Henderson Lagoon

On 14 February this year, scientists were surprised to find a tiny introduced North Pacific Seastar, *Asterias amurensis*, arm radius 1.0 cm, inside a larval trap placed in mid-January in the deepest part of the channel east of the Roses Creek mouth. The following day a 2 cm *A. amurensis* was found in one of the adult crab traps. (These traps are set once a month, overnight, during summer and autumn.) On 14 March a 2.6 cm *A. amurensis* was found under one of the passive collectors, and the next day a 2.5 cm *A. amurensis* was seen on the bottom in the channel, again east of the Roses Creek mouth.

The unfortunate discovery of free-living *A. amurensis* in the Lagoon raises several questions, not least of which is 'How did it get there?' The offshore coastal current on Tasmania's East Coast is from north to south, which would seem to mitigate against spread of *A. amurensis* from infestations near Hobart. Nevertheless, when this pest was first identified in the Derwent over a decade ago, the distinguished marine biologist Isobel Bennett warned one of the authors (TJM) that eventually, one way or another, the wretched starfish would spread to every estuary in Tasmania!

The *A. amurensis* population in Henderson Lagoon is presently small. Further south, though, there have been recent reports of 'very large numbers' of North Pacific Seastars in scallop spat collector bags and suspended 'grow-out' cages near Triabunna. Has the pest spread north to Henderson Lagoon in contaminated recreational fishing gear? Whatever the route, the introduction probably occurred towards the end of the 1990s. Native oysters, *Ostreas angasi*, as well as escapees from

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commercial oyster beds in Georges Bay are sufficiently plentiful in Henderson Lagoon to serve as a ready food source for the adaptable exotic predator.

What will happen if *A. amurensis* spreads to Georges Bay? In time it could decimate the local oyster industry. Assuming there are no discoveries of *A. amurensis* north of Henderson Lagoon, should some sort of quarantine be placed on the Lagoon to reduce the possibility of spreading? An information campaign to encourage public assistance, both to remove North Pacific Seastars from the Lagoon and to end recreational fishing there, might be a sensible initiative.

Meanwhile, Nature has already imposed a barrier which could prevent movement of *A. amurensis* in or out of the Lagoon, and could even result in its complete eradication there without any human assistance. On 9 March the mouth of the Lagoon was closed by a massive sand bar, pushed up by a large northeasterly swell in combination with a big spring tide. A similar closure in February 1999 quickly resulted in the Lagoon becoming a brackish lake; the Lagoon was later re-opened with a bulldozer.

Although a sand barrier could be advantageous from the point of view of pest management, it does have its down-side. Prior to the latest closure, a very low spring and summer rainfall total had led to the development of a stable marine community in Henderson Lagoon. Thick seagrass meadows appeared in parts of the Lagoon where they had not been seen before, fish life increased in abundance and previously unseen invertebrates (native seastars, urchins and octopi) were becoming common.

At the time of writing (4 April) the Lagoon is still closed and is likely to remain so for at least a few more weeks. Since closure, the heaviest one-month rainfall since January 2000 (90 mm) has been recorded. The marine ecosystem in the Lagoon is dying, but hopefully so are all the North Pacific Seastars.

Once upon a time, the sea around Falmouth was seen as the pristine standard against which other Tasmanian estuaries could be compared. Then the Rosy Screw Shell, *Maoricolpus roseus*, appeared in abundance. Next came the European Green Crab, and now the third in a trio of alien marine scourges, *A. amurensis*, has established a 'tube-foothold', albeit a tenuous one. Hopefully that's the last of the bad news from Henderson Lagoon!

Stop press!

Our original article (above) suggested, optimistically, that a natural decline in salinity from rainfall might eliminate the unexpected infestation of *A. amurensis* in enclosed Henderson Lagoon. Indeed, current literature infers that 24 ppt is the minimum level of salinity North Pacific Seastars require to survive. Now, on 17 June, we know we were wrong!

Despite the Lagoon remaining closed to the sea since early March, on 28 May a local professional diver was able to collect, without difficulty, half a bucket of adult *Asterias*. Subsequent salinity measurements around the Lagoon revealed the alien starfish appeared to be thriving in brackish water with salinity levels ranging from 16-20 ppt, and there was no evidence of salinity stratification with depth.

CSIRO scientists were alerted. They in turn consulted with the Marine Resources Division of the Tasmanian Department of Primary Industry, Water and Environment (DPIWE) to devise an action plan. The local rainfall since 9 March had been 190 mm and the Lagoon was very full. It was feared that if the barway was breached, significant numbers of adult *Asterias*, approaching their reproductive period, would be distributed up and down the coast.

A combined operation was mounted to both outline the extent of the infestation and to physically remove as many North Pacific Seastars as possible from Henderson Lagoon. The operation was conducted on the Monday of the June long weekend and involved members of the community from Falmouth and environs. The day before, 21 baited traps had been set over a wide area in an attempt to define, and encourage, sites of greater starfish concentration. The baiting was a failure: only three *Asterias* were found in the traps on the Monday.

The joint scientist/community starfish collection effort was much more successful. In just three hours, 391 *A. amurensis* were captured and measured by six snorkellers and 20 people in an assortment of motorised and paddle craft. All specimens were retained for later examination. Snorkelling seemed to be the most effective method, although rather uncomfortable with the average water temperature at only 9.5°C, but it was clear that many more *Asterias* had been missed because they were hidden in the seagrass.

It is not going to be easy, and it may not be possible, to eradicate *A. amurensis* from Henderson Lagoon. Visual observations indicate there are plenty left, but seven traps deployed during the week after the joint exercise caught only one starfish. It may be that there is too much natural food in the Lagoon for the starfish to be attracted to bait. See the next *Invertebrata* for further developments!

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Editorial

Just a short blast this month from the Editor, mainly to thank all our contributors for making *Invertebrata* 20 a particularly rich feast of interesting reading.

Invertebrata 21 will have coverage of Tasmania's Nature Conservation Strategy (TNCS), which we are advised has now been approved by the Minister and is off to the printers. The November issue will also report on this month's joint conference of the Society of Australian Systematic Biologists and the Australian Evolution Society.

* * *

Wingless Tasmanian snow fleas (Mecoptera: Apteropanorpidae) were featured in previous issues of *Invertebrata* (November 1997 and March 1999). Readers may have gotten the idea from those articles that *Apteropanorpa* is rare. Dick Bashford now reports that eight of his IBOY pitfalls on Mt Weld (see p. 12, this issue) have so far yielded several thousand specimens!

Tasmanian earthworm grows second head

During my Tasmanian earthworm studies, I came across a native specimen that was an anterior regenerate – it was growing a replacement 'head' (Fig. 1). This phenomenon is well reported in exotic species, but this is the first confirmation for an Australian native. I have frequently observed both tail and head regenerates of *Perionyx excavatus* Perrier, 1872; have once seen *Pontoscolex corethrurus* (Muller, 1856) in the process of growing an new head; and have collected a specimen of *Lumbricus rubellus* Hoffmeister, 1843 with this condition (specimen ANIC:RB.01.01.01). The present report and sketch will help convince skeptics who, while accepting posterior regeneration, doubt that it is possible for worms to grow new heads. Such regrowth is often in response to mechanical damage from predators or the garden spade, but it may also be evoked by disease and tail autotomy (Stephenson 1930). G.E. Gates spent 10 years studying regeneration in a variety of species, but *'because little interest was shown'* he only published a few of his findings that, nevertheless, show it is theoretically possible to get two whole worms from a bisected specimen of certain species. His reports (see Gates 1972) included:

Eisenia fetida (Savigny, 1826) with head regeneration, in an anterior direction, possible at each intersegmental level back to and including 23/24, while tails may be regenerated at any levels behind 20/21.

Lumbricus terrestris Linneus, 1758 can replace anterior segments from as far back as 13/14 and 16/17 but tail regeneration has never been found for this species.

Perionyx excavatus Perrier, 1872 readily regenerates lost parts of the body, in an anterior direction from as far back as 17/18 and a new tail is possible from as far forward as 20/21.

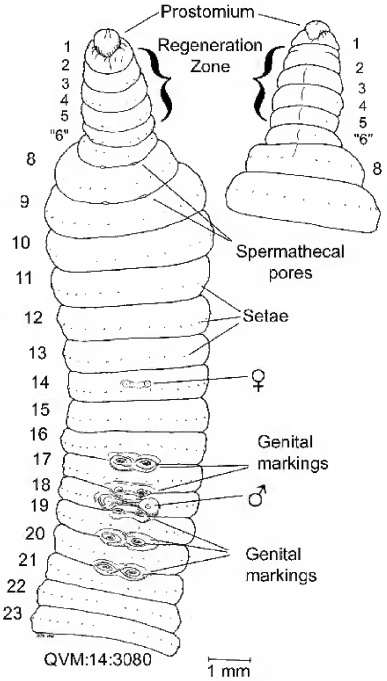

Fig. 1. Tasmanian earthworm that has regenerated new "head".

The specimen here (Fig. 1) shows typical characteristics of regeneration: the regrown segments are thinner and paler than normal; one segment (6?) has also been deleted. Queen Victoria Museum (QVM) collection notes for this specimen record the site as Tombstone Creek Forest Reserve (41° 23"S, 147° 42"E), north-east Tasmania. The actual species is not characterized as no dissection was attempted, however it is possibly one of the 230 species now known from Tasmania (see Blakemore 2000), and is superficially close to *Perionychella richea* (Spencer, 1895).

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Further information:

Blakemore, R.J. 2000. *Tasmanian Earthworms.* CD-ROM monograph with review of world families. Pp. 800 including 222 figures. Published by VermEcology, PO BOX 414, Kippax ACT 2615. ISBN 0-646-41088-1.

Gates, G.E. 1972. Burmese Earthworms, an introduction to the systematics and biology of Megadrile oligochaetes with special reference to south-east Asia. *Transactions of the American Philosophical Society* 62(7): 1-326.

Stephenson, J. 1930. *The Oligochaeta.* Oxford: Oxford University Press.

Many *Invertebrata* readers will have known the late and much-loved Mary Cameron. An Honorary Associate and Honorary Research Associate in botany at the Queen Victoria Museum and Art Gallery for nearly 30 years, Mary edited the very popular handbook *A Guide to Flowers and Plants of Tasmania* for the Launceston Field Naturalists Club. She was also an Honorary Curator of the Tasmanian Herbarium and a life member of the Royal Society of Tasmania. In recognition of her contributions to Tasmanian botany she was named a Member of the Order of Australia in 1993 and received the Australian Natural History Medallion in 1999.

It was Mary's wish that in lieu of floral tributes following her death last January, equivalent monetary donations be made to the Winifred Curtis Scamander Reserve Trust. This private land Reserve, on the east side of Henderson Lagoon, grew in 2001 from 2 ha to almost 80 ha thanks to a land purchase made possible by private donations and a grant from the Natural Heritage Trust. Vegetation includes *Eucalyptus amygdalina/E. viminalis* woodland, *E. ovata* woodland, *Allocasuarina littoralis* forest, coastal heath and saltmarsh.

Contributions to the Trust are tax-deductible. The Trust also welcomes invertebrate surveys on the property. For further information please contact the Trust chairman, Dr Tim McManus, 35 Hammond Street, Falmouth TAS 7215; 6372 5480.

Parental care in leeches

A goal of evolutionary biology is to explain why species evolve different behaviours in response to factors that challenge their survival and reproduction. The evolution of parental care in animals is especially difficult to explain due to the variety of methods by which species have overcome the problems associated with caring for young in diverse environments. The study of parental care examines, in detail, the various methods by which different animal groups successfully care for their developing eggs and young. Diversity in parental care strategies ranges from the abandonment of eggs either by broadcast spawning or by depositing eggs on a suitable substrate, to nesting with extensive care of the eggs and hatchlings, and finally to bearing live young (vivipary) and then rearing them until they are able to care for themselves.

Most research into the evolution of parental care has focused on vertebrate species with few studies examining non-social insects or other invertebrate groups (Clutton-Brock 1991). In an attempt to expand our knowledge and to gain a better understanding of the evolution of parental care in general we have started a research effort to investigate the evolution of parental care in a currently under-studied invertebrate group, the glossiphoniid leeches. Glossiphoniids can be found in lakes, ponds and the slower portions of streams and rivers in Tasmania and throughout the mainland of Australia. There are currently ten species recognised from Australia (two of which are restricted to Tasmania). It is likely, however, that there are still many undescribed Australian species.

Although 'leech' is often considered synonymous with selfishness and exploitation, many leeches are devoted parents. After fertilisation, sexually mature leeches produce cocoons that contain a variable number of eggs (depending on species). In many non-glossiphoniid leeches, the cocoon contains stored energy that sustains the developing eggs and hatchlings with no further investment from the parents. However, in the Glossiphoniidae, parental care ranges from abandonment after egg deposition, to parental brooding of egg clusters in a external nest, to the brooding of eggs and young on the parent's body, to internal gestation in a marsupial-like pouch. In addition, some genera (e.g. *Glossiphonia*) are known to transfer nutrients across the body wall to the developing young in a manner reminiscent of a 'placenta' (Sawyer 1986; Kutschera & Wirtz 1986a, 1986b; Kutschera 1989, 1992; De Eguileor *et al.* 1994; Davies *et al.* 1997; Govedich & Davies 1998). Unlike non-glossiphoniids, the energy required for development and growth in glossiphoniids comes from both the egg yolk and the parent.

During 2001 two honours students from Monash University have begun looking at costs and benefits of parental care in *Helobdella papillornata*. To this end Lauryne Grant will be examining the influence of varying the duration of care on the individual fitness of both parents and juveniles. George D. Cunningham is working on clutch size.

Duration of care

In wild populations, time between fertilisation of eggs and their attachment to the ventral surface is approximately one week. The eggs are then brooded on the ventral surface of the leech in a fluid filled membranous sac for approximately one week. After hatching, juveniles are brooded on the adult for approximately three weeks (Govedich & Davies 1998). During this time it is thought the adults provide care to the young through several mechanisms, including direct feeding where the parent captures prey and passes the food directly to the young (Davies *et al.* 1997). The degree to which the young depend on the food provided by their parent has not been extensively studied particularly for juveniles in the later stages of development. In addition, direct nutrient transfer across the body wall from the parent to the developing young has been found in the genus *Glossiphonia* (de Eguileor *et al.* 1994). How common this type of nutrient transfer occurs is not known, and *H. papillornata* has not been studied to determine if nutrients are transferred. Parents also act in a protective role, defending their young against predators. Additionally, the composition and importance of the fluid in the membranous sac surrounding the eggs is unknown.

L.J. Grant's initial experiment will involve manipulation of the degree of care juveniles receive. This will be achieved by detaching juveniles from their parent at different stages of development. The effect of these varied levels of care will be examined for both the adult and the juvenile. Growth rate and reproductive timing are the major factors used to estimate the fitness of adults and juveniles. Parental care mechanisms including parental feeding, protection and membranous sac contents will be examined. This study will include artificial feeding experiments, to determine whether survival of detached juveniles is enhanced when food is artificially provided. Response to

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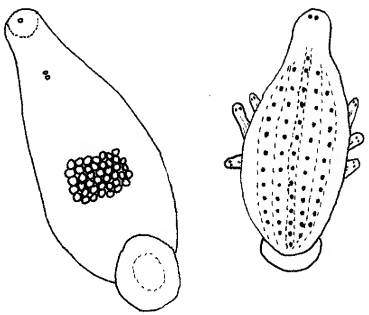

Helobdella papillornata, a glossiphoniid leech that cares for its young.
Left: Ventral surface of parent showing attached eggs.
Right: Dorsal surface of adult with young peeking out from under the par-

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predators will be investigated in order to discover whether brooding adults respond differently to non-brooding adults in the presence of predators. Predator size and type may also be varied to determine whether brooding adults have different responses to predators that threaten their young. Additionally, fluid within the membranous sac surrounding the eggs will be tested in order to determine its composition.

Clutch size

Two types of conflict influencing the size of clutches will be studied, sibling conflict and parent-sibling conflict. These conflicts will occur due to the different interests of the parent and its offspring in 'attempting' to maximise their own (inclusive) reproductive fitness.

Sibling conflict can occur when an individual raises its individual fitness to an extent that compensates for a lowering of its siblings' fitness. This can lead to fatal sibling competition, termed sibliciide, or 'cainism'. Thus some individuals in the brood will be selected to eliminate siblings either through direct means (killing of siblings) or through competition (control of resources). The degree and severity of this competition is likely to increase as resources are reduced, and as clutch size is increased (Mock & Parker 1997). Parent-sibling conflict arises when the parent attempts to maximise the fitness of the current and future broods in conflict with the interests of individuals in the current brood (Mock & Parker 1997).

G. D. Cunningham will examine sibling competition and parent-sibling conflict by altering the clutch sizes of *Helobdella papillornata*. The relationship between these conflicts and the number of juveniles in a given clutch will be estimated by examining the health of juveniles, and parents. Juveniles will be removed or added to a brood and a digital camera will be used to record the growth rate, size and survivorship of individuals to estimate the fitness of juveniles. Parental fitness will be estimated using growth rate, and time to and size of the next clutch.

Why leeches?

Glossiphoniid leeches provide an ideal group of animals for the study of parental care because of the diversity in parental care found within one family, reducing the problems of studying distantly related and often very different animal groups (ie. reptiles to mammals). In addition, leeches can be easily maintained in the laboratory and studied over their entire life cycle (glossiphoniids go from egg to adult within four to six months) and several generations can be studied in a relatively short period of time resulting in relatively quick data acquisition. Glossiphoniid leeches can also be studied without having to worry about large study areas (they are quite happy in small take-away containers) and do not have many ethical problems associated with their study. Hermaphroditism in leeches also offers a means of separating male/female evolutionary conflicts over parental care from the selective pressures for care *per se*. Thus, this group provides a potentially rich source of experimental material for evolutionary study.

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Further information:

Clutton-Brock, T.H. 1991. *The evolution of parental care*. Princeton: Princeton University Press.

Davies, R.W., McLoughlin, N.J. and Oosthuizen, J.H. 1997. The life-cycle and feeding of the African freshwater leech *Helobdella conifera* (Glossiphoniidae). *South African Journal of Zoology* 32:1-4.

de Eguileor, M., Daniel, S., Giordana, B., Lanzavecchia, G. and Valvassori, R. 1994. Trophic exchanges between parent and young during development of *Glossiphonia complanata* (Annelida, Hirudinea). *Journal of Experimental Zoology* 269:389-402.

Govedich, F.R. and Davies, R.W. 1998. The first record of the genus *Helobdella* (Hirudinoidea: Glossiphoniidae) from Australia, with a description of a new species, *Helobdella papillornata*. *Hydrobiologia* 389:45-49.

Kutschera, U. 1989. Reproductive Behaviour and Parental Care of the Leech *Helobdella californica* (Hirudinea: Glossiphoniidae). *Zoologischer Anzeiger* 222:122-128.

Kutschera, U. 1992. Reproductive Behaviour and Parental Care of the Leech *Helobdella triserialis* (Hirudinea: Glossiphoniidae). *Zoologischer Anzeiger* 228:74-81.

Kutschera, U. and Wirtz, R. 1986a. Reproductive Behaviour and Parental Care of *Helobdella striata* (Hirudinea, Glossiphoniidae): a leech that feeds its young. *Ethology* 72:132-142.

Kutschera, U. Wirtz, R. 1986b. A leech that feeds its young. *Animal Behaviour* 34:941-942.

Mock, D.W. and Parker, G.A. 1997. *The Evolution of Sibling Rivalry*. Oxford: Oxford University Press.

Sawyer, R.T. 1986. *Leech biology and behaviour* (volumes I-III). Oxford: Oxford University Press.

Notices & reviews

Moore, J. 2001. *An Introduction to the Invertebrates*. Cambridge: Cambridge University Press; 355 pp. Paperback ISBN 0521779146, $44.95.

The standard university-level invertebrate zoology texts are over-packed with detail. What hope do beginning students (and lay readers) have of abstracting from the bewildering tangle of facts the broader patterns of invertebrate life? On the other hand, popular books on invertebrates are often little more than 'bestiaries', long on pictures and capsule summaries of individual groups, but short on the biological linkages between higher taxa. Janet Moore's *An Introduction to the Invertebrates* offers something different: a smartly annotated, comprehensive outline. The writing is clear, simple and to the point. The chapters are organised taxonomically, but within the chapters the topic heads are broad zoological questions, instead of the drearily repetitive '...nervous system, excretory system, reproduction, development, etc...' Twelve independent text-boxes deal simply with physiological subjects. The 'Further Reading' chapter is large and heavily biased towards books and papers of the 1990s.

Moore has been teaching invertebrate zoology to Cambridge University undergraduates for many years, and is now officially retired. If you suspect from that information that Moore is the sort of old-timer who snorts contempuously at 'all that new molecular fiddle-faddle,' you couldn't be more wrong. Genetics features throughout the *Introduction*, its relevance is clearly explained, and there are lucid discussions of the new links between fossil history, molecular phylogeny and developmental genetics. If it's been some years since you studied zoology, and you've never heard of Ecdysozoa and Lophotrochozoa, *Hox* genes and new interpretations of homology, start here for your update.

– Bob Mesibov

Australian Ants Online!

The Australian National Insect Collection and CSIRO Entomology are happy to announce that **Australian Ants Online** is now available at

www.ozants.com and

www.ento.csiro.au/science/ants.

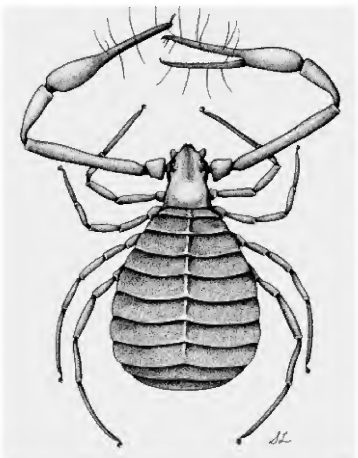
The site, prepared by Steve Shattuck and Natalie Barnett, provides information on the biology and identification of the entire Australian ant fauna to genus level with catalogues and distribution information to species level.

Be sure to visit the site regularly as we work towards a complete guide to the Australian ant fauna at the species level.

A little bit of the north is down south

Tasmania has long been regarded as a biological treasure trove, supporting an astounding range of species found nowhere else, many of which have survived the perturbations of climate change during the Pleistocene. The late Prof. V.V. Hickman, Professor of Zoology at the University of Tasmania, spent his research career hunting out peculiar arachnids and other invertebrates, and documenting the unusual fauna of the southern isle. He described a plethora of Tasmanian oddities including *Plesiothele fentoni*, a primitive mygalomorph spider, and *Holarchaea globosa*, a minute araneomorph spider whose closest relative occurs in New Zealand. Hickman's link with arachnids and Tasmania is indelibly forged – the large cave-dwelling spider *Hickmania troglodytes*, the sole member of the subfamily Hickmaniinae, bears his name.

Hickman was also responsible for the discovery of one of the most unusual of Tasmania's arachnids. It all started with his inclination for collecting in the Launceston region which is nestled amongst some lovely hills, many of which are still forested to this day. He collected some peculiar pseudoscorpions which he handed to a student for study. J.C.H. Morris found that one of them was a member of the family Pseudogarypidae, a peculiar pseudoscorpion family which previously had been found only in the northern hemisphere, with several extant species of *Pseudogarypus* in North America (particularly in the Appalachians and the Rocky mountains), and some extinct species of the same genus found entombed in amber deposits from the Baltic region. Pseudogarypids have yet to be found in any other part of the world, including mainland Australia. Morris named the Tasmanian species *Neopseudogarypus scutellatus* and noted that Hickman had collected it in the Launceston area (Morris 1948). My visits to Cataract Gorge in 1986 and 1989 revealed that the species could be found under large rocks in the drier portions of the gorge, normally on slopes with casuarina trees. Despite careful searching for over 20 years, I have not found any pseudogarypid in mainland Australia.



Neopseudogarypus scutellatus

A relict pseudoscorpion so far known only from the Launceston area

Many years after the discovery of pseudogarypids in Tasmania, I examined a pair of pseudoscorpions collected at Frodshams Pass in southern Tasmania by Ian Naumann and Josephine Cardale of CSIRO Entomology. They were totally different to any pseudoscorpion which I had ever seen from Australia, and it took much detective work to establish their identity. Finally, I found that they were extremely similar to members of the genus *Syarinus* (Syarinidae) which are found in the northern hemisphere across the U.S.A. and southern Canada and in northern Europe. However, I found sufficient morphological differences between the Tasmanian species and the northern ones to warrant the erection of a new genus, *Anysrius*, and a second species from northwest Tasmania was also described (Harvey 1998). Once again, *Anysrius* has not been found in mainland Australia, and it appears to be endemic to Tasmania.

The similarities between the distribution patterns of these two groups of pseudoscorpions is remarkable, with species in the Holarctic region and in Tasmania – but nowhere else. As these small, relatively fragile creatures are unlikely candidates for trans-oceanic dispersal it seems that their biogeography can be best explained by vicariance: the common ancestors of both groups were distributed on the ancient supercontinent Pangea, which broke apart during the Cretaceous. The separate fragments took with them the biota of the time. It seems that the precursors of *Neopseudogarypus* and *Anysrius* ended up in the southern fragment, Gondwana, and have only managed to survive in isolated pockets of Tasmania. Whilst they may eventually be found in other southern areas (mainland Australia, New Zealand, South America or southern Africa), the only known stronghold of these small southern representatives of an otherwise northern group is in Tasmania – two truly remarkable cases of relictual endemism.

I would be happy to examine Tasmanian pseudoscorpions, especially if somebody can uncover further populations of either *Neopseudogarypus* or *Anysrius*.

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Further information:

Harvey, M.S. 1998. Pseudoscorpion groups with bipolar distributions: a new genus from Tasmania related to the Holarctic *Syarinus* (Arachnida, Pseudoscorpiones, Syarinidae). *Journal of Arachnology* 26: 429-441.

Morris, J.C.H. 1948. A new genus of pseudogarypin pseudoscorpions possessing pleural plates. *Papers and Proceedings of the Royal Society of Tasmania* 1947: 43-47.

Pycnogonids (sea spiders) of southeastern Australia and Tasmania

The coastlines of southeastern Australia and Tasmania are virtually unexplored in terms of some of the smaller invertebrate groups, particularly the sea spiders or Pycnogonida. The most up-to-date list of pycnogonid species for all of Australia can be found at **www.invertebrate.ws**, which is my personal website*. This list has 81 species of pycnogonids and is far from complete. For the last three years, I have been doing some sporadic pycnogonid collecting from areas such as Westernport Bay, Port Philip Bay and Kennett River (near Apollo Bay) here in Victoria, and nearly every pycnogonid I have found so far is a new species. My most recent collection, from South Channel Fort in Port Philip Bay, also contains at least one new genus. I spend most of my collecting time carefully looking through clumps of red algae, bryozoans, mussels, etc. and it really helps to take most of this stuff back to the lab and sort through it under a dissecting microscope as most of the new species (and the new genus) tend to be very small (1-2 mm) and nondescript (white or yellowish in colour), which may explain why they have been overlooked in the past.

Nearly all of the larger and more colourful pycnogonids from this area have already been described since they are easily spotted and make nice colourful photographs for dive brochures and magazine covers. In fact, over the past two years, many of the larger and more colourful species from here have found their way into a number of different publications including *National Geographic* (October 1999), *Australian Geographic* (January-March 2000), *Fisheries, New South Wales* (Summer 2000), and *Newton* (a new Australian Geographic Society publication) (May-June 2001). It is interesting that even though all of these species have been described before and most could have been easily identified by reading the key in Staples (1997), nearly all of them were published as a 'pycnogonid' or 'sea spider.' The *National Geographic* at least had its photo identified to genus (*Pseudopallene*) and only *Newton* had their picture identified down to species (*Colossendeis colossea*).

Another area of pycnogonid biology I am currently working on is pycnogonid larval development. I have just completed a review article and a paper describing development in an Antarctic pycnogonid, *Austropallene cornigera*, and hope to have them both published soon. Most books and articles on pycnogonids will tell you that there is only one kind of pycnogonid larva, the protonymphon, and after that, they tend to be very vague on the details of pycnogonid development. It turns out, if one looks into the question in more detail, that there are at least four different ways in which a pycnogonid can go from egg to adult (Typical Protonymphon, Encysted Larva, Atypical Protonymphon, Attaching Larva), and a protonymphon larva, depending on species, can develop along any one of the first three pathways described above.

The Typical Protonymphon, characteristic of most ammotheids, is a free-living larva which gradually, through a series of molts, becomes an adult. The Encysted Larva, confined to the Family Phoxichilidiidae and to one North American ammotheid, hatches from the egg and goes directly to a bed of hydroids or corals where it then becomes encysted in the polyp or gastrozooid (see Staples (1997) for some nice colour photos of these larvae). It remains there for several molts and usually re-emerges from the hydroid as a young juvenile with three pairs of walking legs. The Atypical Protonymphon also uses a marine invertebrate for a temporary host and this larval type has been found living on a polychaete, *Sabella melanostigma*, in the Gulf of California and also inside several different Japanese clams (*Ruditapes philippinarum*, *Hiatella orientalis*). We don't know much else about development in the Atypical Protonymphon except that the adults in all cases are free-living and the larvae and juveniles are confined to their temporary hosts. The fourth type of pycnogonid development, the Attaching Larva, is found only in the families Nymphonidae and Callipallenidae. This larva looks more like an embryo than anything else (see Nakamura (1981) for pictures) and as soon as it hatches, it glues itself to the parent's ovigerous legs and stays there for the next several molts. It usually leaves the parent and takes up a free-living existence once it becomes a young juvenile with (depending on species) either two or three pairs of walking legs.

I am starting work soon on a monograph of new pycnogonid genera and species from southeastern Australia (including Tasmania) and I would be very interested in examining any pycnogonid specimens which have been collected from this area. You can send specimens to me at Monash University (address below). Either live or preserved specimens are fine since we have facilities to keep live ones and whenever possible, I try to keep them alive for a few months so that I can photograph them and take notes on feeding behaviour, larvae, etc. Live pycnogonids do well in the post if they are placed in a small vial of sea water and are shipped by express mail. Most species will survive for several days like this and in one case (probably an exception!), I had live specimens shipped to me from Queensland which had spent a week in transit and survived just fine. When in doubt, preserve them first in 70% alcohol.

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Further information:

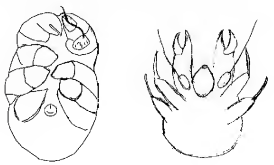
Arnaud, F. and Bamber, R.N. 1987. The Biology of the Pycnogonida, pp. 1-96 *in* Blaxter, J.H.S. and Southward, A.J. (eds), *Advances in Marine Biology*, vol. 24. New York: Academic Press.

Clark, W. C. 1963. Australian Pycnogonida. *Records of the Australian Museum* 26(1): 1-81.

Edgar, G. J. 2000. Australian Marine Life (revised edition). Sydney: Reed New Holland. (Pycnogonids on pp. 166-167).

Nakamura, K. 1981. Post-embryonic development of a pycnogonid, *Propallene longiceps*. *Journal of Natural History* 15: 49-62.

Staples, D. A. 1997. 21. Sea spiders or pycnogonids (Phylum Arthropoda), pp 1040-1072 *in* Shepherd, S.A. and Davies, M. (eds.), *Marine Invertebrates of Southern Australia, Part III*. Adelaide: South Australian Research and Development Institute.



Ventral views of two pycnogonid (sea spider) larvae.

Left: Protonymphon. Right: Attaching larva.

*Also **www-personal.monash.edu.au/~fgodevic//seaspider/index.htm**

Happily bugged

To celebrate National Science Week the Burnie Library organised a 'Bug Us at the Library' morning on Saturday, 5th May. '*Bring your garden bugs, insects and creepy crawlies*', said the publicity material, '*to be identified by experts*', namely the authors of this note. When the day arrived neither of us was feeling particularly expert. We rolled up to the Library laden with reference books, CSIRO Entomology posters and pinned specimens. Who would come, and with what? To soothe our nerves the Library staff administered large cups of tea and heaping platefuls of cake and biscuits. Staff had also organised two long tables for us at which to meet clients, and had made up their own bugs display of books from the lending collection.

It wasn't too bad. We had 14 interviews in two hours with North-West Coasters from Wynyard to Penguin. The tally of bugs (in order of appearance) was:

1 theridiid spider (the redback look-alike without the stripe)
2 Fuller's Rose Weevils, *Asynonychus cervinus*
1 Cabbage White larva, *Pieris rapae*
1 arctiid moth
2 spirosteptidan millipedes (natives)
1 land snail, *Helicarion cuvieri*
1 clubionid spider
1 gnaphosid spider
several talitrid landhoppers
1 stink bug
1 lycosid and 1 salticid spider
1 tree lucerne moth, *Uresiphita ornithopteralis*
1 mole cricket, *Gryllotalpa* sp.
3 sugar ants, *Camponotus* sp.
1 anthelid moth larva, *Anthela* sp.
1 daddy-longlegs spider, *Pholcus phalangioides*
numerous spotted millipedes, *Blaniulus guttulatus* (in a strawberry)
1 Portugese millipede, *Ommatoiulus moreleti* (in the same strawberry)
1 theridiid spider and 1 ?gnaphosid spider
1 psychid moth larva
2 burrowing crayfish, *Engaeus fossor*
several ?Argentine ants
1 leaf-curling spider, *Phonognatha* sp.

We were also told about a large stick insect, a praying mantis, Emperor Gum Moths, introduced bumblebees at Ridgley and a fast-running spider (almost certainly *Supunna* sp.).

Of the 14 interviews, seven were with young children and their parents. We did our best to encourage the kids and to suggest that bug study was rewarding and interesting. It was a bit harder to get this message across to the adults who had come with '*How do I get rid of this?*' inquiries.

We enjoyed the morning and wouldn't mind repeating the exercise. The book we used most often with our clients was the excellent *Backyard Insects* (Paul Horne & Denis J. Crawford, Miegunyah Press, 1996). Next time, a reference collection of specimens would be a useful aid. Or maybe (in future) a website with images of, say, the 200 most-often seen suburban invertebrates…

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Bob Mesibov
(Editor, Invertebrata*)*

News from QVMAG

Things are happening at the Queen Victoria Museum – at the moment it is mainly talking and 'moving deck-chairs', but it's all very promising. I took over as Acting Curator of Zoology in April, working three days a week and Bob Mesibov joined the staff just over a month later working two days a week. Bob's position is Curatorial Specialist and his main task initially is to undertake an audit of the earthworm collection, about which there has been some recent contention. Lisa Joy Boutin is also part of the team, being employed on outside funding to continue her spider work (though she is currently collecting in Northern Territory, having returned not too long ago from New Caledonia and Madagascar!). So Zoology at the QVM now consists of six part-time staff – the three mentioned above plus Tammy Gordon, Judy Rainbird and Craig Reid. Our area of responsibility has also increased to include a collection management role for the Botany holdings, though we are not fielding botany inquiries.

We have done some reorganising of office and laboratory space and are now moving forward on several fronts. Work should be starting in the next couple of months on the first stage of our new Zoology wet store, to provide better housing for material preserved in alcohol. The store is being built on the Wellington Street site, the first stage should be completed this calendar year and this will allow us to bring the vertebrate collections back from the temporary store at Rocherlea. Rehousing and a curatorial up-date of this collection will be carried out prior to its move to the new store. The new dehumidifier in our main Zoology store in the TAFE College is working well to counter the effects of the cold, damp Launceston winter.

This general increase in 'house-keeping' activity is spilling over into other areas of collection management. Working sessions with our system manager Mark Gordon have commenced, aimed at bringing our nine zoological collection databases ultimately down to two: vertebrate and invertebrate. This will make for much more effective database management and will greatly increase the quality of our collection data.

All this activity on 'collections' has still allowed some time for progress in the other two areas of responsibility, namely research and public programmes. Lisa, Bob and Brian are continuing work on spiders, millipedes and snails, respectively, with Brian also preparing another issue of *Molluscan Research* for publication. Public inquiries have slackened off a bit over winter but still occupy significant time for Judy, Tammy and Craig. These three have also been involved with the new 'Discovery Plus' activity area which has been moved to a larger gallery. 'Discovery Plus' contains quite a bit of zoological material and is proving very popular with school groups and families – thanks to the work of Alisanne Ramsden and her team. Although the major focus of QVM staff will be the opening of the Inveresk Railyards complex later this year, natural history in the Wellington Street building hasn't been forgotten, and our work rate has increased!

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The riddle of Schayer's slater, *Spherillo misellus* (Crustacea: Isopoda)

The first species in the crustacean suborder Oniscidea (Isopoda) to be based on a Tasmanian slater was *Armadillo misellus* Budde-Lund, 1885. Budde-Lund described it in Latin from a single specimen collected in Van Diemen's Land by 'Dom. Scheyer' and lodged in a Berlin museum. (Note that an English translation of the description, by Thomson (1893), contains some mistakes.) Later Budde-Lund (1904) transferred *A. misellus* to the genus *Spherillo* Dana, 1852, and updated the locality name to 'Tasmania'.

I have studied terrestrial isopods from 1956 onwards but I have not yet seen a slater which I can identify with certainty as *S. misellus*. The holotype of the species is no longer in Berlin. It may not have been returned from loan to Budde-Lund, who died before his isopod studies were finished. The original collecting locality might have been anywhere in Tasmania so the chances of learning more about *S. misellus* seemed remote.

Recently, however, I learned that Adolphus Schayer, from Berlin, arrived in Tasmania in 1831 to work for the Van Diemen's Land Company. At first Schayer was based at Circular Head (now Stanley). From January 1835 to January 1843 he was Superintendent of the V.D.L. Company's station at 'Woolnorth', in Tasmania's northwest corner. Schayer collected many Tasmanian insects, and some crustaceans, before he returned to Berlin. It seems likely that Budde-Lund's 'Dom. Scheyer' was Superintendent Schayer and that his specimen of *S. misellus* was found in far northwestern Tasmania..

Among the Tasmanian Armadillidae, *Cubaris tamarensis* Green, 1961, comes closest to Budde-Lund's *S. misellus*. *C. tamarensis* has been collected from the Furneaux Group, Swan Point (West Tamar), Hawley Beach and West Ulverstone (NW coast), three sites north of Sandy Cape and Hibbs Lagoon (west coast). Thus the far northwest corner of Tasmania is within the known range of *C. tamarensis*.

Although not supralittoral, *C. tamarensis* does live near the coast and is easier to find than most forest slaters. It has unusually long scale-setae, which might represent the pubescent dorsal surface noted by Budde-Lund for *S. misellus*. However, some other characters of *C. tamarensis*, especially structures on the first pereon segment, do not match Budde-Lund's account.

The genus *Spherillo* has had a confused history. A type species, selected recently, will help to solve some taxonomic problems. *Spherillo* species which are not compatible with the type need to be re-examined, *S. misellus* included. Budde-Lund's species does not belong in *Cubaris* Brandt, 1833, and *C. tamarensis* is not a typical *Cubaris*. What was actually collected near 'Woolnorth' by Superintendent Schayer?

The riddle of Schayer's slater waits to be solved.

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Further information:

Budde-Lund, G. 1885. *Crustacea Isopoda terrestria, per Familias et Genera et Species descripta*. Hauniae.

Budde-Lund, G. 1904. *A Revision of 'Crustacea Isopoda terrestria' with additions and illustrations*. Parts 2 & 3, pp. 32-144. Copenhagen: H. Hagerup.

Thomson, G.M. 1893. Notes on Tasmanian Crustacea, with descriptions of new species. *Papers and Proceedings of the Royal Society of Tasmania* 1892: 45-76.

Land planarians found on Macquarie Island

Terrestrial flatworms have been recorded for the first time from Macquarie Island. Specimens were collected on part of the island distant from the Antarctic Station by Rod Blakemore whilst working on a survey of Macquarie Island invertebrates directed by Penny Greenslade.

One of the two species of flatworms collected belongs in the genus *Arthurdendyus* that includes five described native New Zealand flatworms; all are earthworm feeders. *Arthurdendyus triangulatus* and *A. albidus* have been recorded in the UK as introductions. *A. triangulatus* has had a well-documented damaging effect on earthworm populations in the UK and the Faroe islands. The new species of *Arthurdendyus* on Macquarie Island is similar to an undescribed species from the south island of New Zealand, and may be an introduction. It appears that the new species may also be a predator of earthworms as no earthworms were found where the flatworm was present although they are abundant on other parts of the island.

Specimens of the second species found are unfortunately immature, and as yet cannot be confidently assigned to a genus. The morphology and markings of the species are similar to certain flatworm taxa from the New Zealand subantarctic islands, and it is highly probable that the species is native to Macquarie Island.

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Wanted! Wanted! Wanted!

Reports of 'people news' and invertebrate goings-on from DPIWE, Inland Fisheries Commission, CSIRO Marine Labs, University of Tasmania departments and any other agencies, institutions or individuals studying invertebrates in Tasmania. We and our readers are especially keen to hear from non-professional zoologists with tales and tidbits about this State's wonderful invertebrate fauna. Pictures are very welcome, both to illustrate animals under discussion and to make *Invertebrata* look more interesting. Contributed pictures should preferably be black-and-white line illustrations, not in colour and not in a range of grays. Illustrations can be e-mailed in any image format, preferably zipped if not .jpg.

A study of *Astacopsis gouldi* habitat in two rivers in northwest Tasmania: summary of Honours research at the University of Tasmania

From August 2000 to January 2001, I studied how habitat parameters affect the population structure of *Astacopsis gouldi* Clark and the number of taxa and abundance of other aquatic macroinvertebrates. Reasons for the decline in populations of *A. gouldi* have been generally accepted to be over-fishing and habitat loss and degradation. However, changes in any one of the many variables of the riverine environment, either natural or as a result of human activity, can cause major changes in the composition of aquatic communities.

Six study sites were selected: paired sites in three distinct riparian environments. Two sites were intensively grazed pasture-land, two had mature pine plantation on one bank and native vegetation on the other, and the last pair were set within undisturbed native wet sclerophyll/mixed rainforest. The study sites, each *ca.* 500 m long, were located along two rivers in northwest Tasmania and were between 30 and 100 m above sea level. Vegetation composition, vegetation coverage and topography were recorded for each site. At each site I measured the population density and size range of *A. gouldi* and the abundance of a range of other aquatic macroinvertebrates. River water was tested for dissolved oxygen, pH, maximum and minimum water temperatures, nitrates, nitrites, phosphates, ammonium and conductivity. Physical conditions on-site and upstream were assessed. Site variables were then examined for correlations with population structure of *A. gouldi* and with the composition and abundance of the aquatic macroinvertebrate community generally.

Little correlation was found between populations of *A. gouldi* and water chemistry. However, a sharp spike in nitrate levels in September at all sites except site N2, where the largest population was found, invites further investigation. It was found that lobsters were not active below *ca.* 8°C and above *ca.* 18°C. In addition, few females were caught during January, suggesting a change in behaviour over this period.

Wide variation was found between sites in numbers of lobster captured. A cause for concern was that although over 200 lobsters were caught over the six-month study period, only five females were found to be in berry. Greater numbers of young lobsters were present at the more productive sites, but only low numbers of breeding-size females were found. Healthy populations of *A. gouldi* (with a wide range of sizes, including breeding size) were found at only one site (N2) where riparian vegetation was intact both at the site and upstream. One possible explanation for the healthy populations at site N2 is that its streamside trees are a source of organic matter in the form of leaves, twigs and logs for the rivers, and provide essential food and shelter for the lobster and other aquatic invertebrates. However both of the pine sites (P1 and P2) and the second native site (N1) offered these conditions but did not carry as high a population of *A. gouldi*.

The data suggest that where instream organic matter was not a limiting factor, the major influence of streamside vegetation on populations of *A. gouldi* was through the moderation of water temperature. Where large stretches of river were unshaded by trees upstream of sites, water temperature in summer was much higher than at those sites where upstream riparian vegetation was intact. Correspondingly, populations of the lobster were lower at sites where water temperatures were comparatively high, even where vegetation within the site was intact.

Figure 1 illustrates the difference in temperature range from site to site over the study period. The smallest range was found at the native site N2, where riparian vegetation both at the site and upstream was intact. Interestingly, the largest temperature range was at site N1, the second native site. This site had similar within-site conditions to site N2, but logging upstream had left the river exposed without a buffer zone for several kilometers. The two pine sites P1 and P2 also reflect the loss of an upstream riparian zone in their comparatively large temperature ranges. The rivers at the two farm sites F1 and F2, although both situated in open farmland with no riparian buffer zone, reinforce the importance of their upstream riparian vegetation by a reduction in overall mean temperature range.

Figure 2 shows the total biomass of lobsters caught at each site. Comparison of the biomass caught and the temperatures at each site, shown in Figure 1, suggest a relationship between populations and water temperature. Sites F2 and N2 represent the farm and native sites respectively on one river with little upstream disturbance, while sites F1 and N1 represent the farm and native sites respectively on a second river which has experienced major upstream disturbance within 3 km upstream of site N1.

The discovery of strong correlations between the presence of several families of aquatic invertebrates and presence of healthy populations of *A. gouldi* reinforced these findings. Where sites experienced increased water temperatures and loss of riparian vegetation, especially upstream of the site, populations of the lobster were low and populations of the correlated species of aquatic macroinvertebrate were either sparse or absent.

The results of this study have implications for land management, reinforcing the message that adequate riparian buffer zones need to be retained along streams. Land managers should also be aware that activities in the headwaters of streams will have an impact on downstream aquatic habitats, with an impact in particular on populations of *A. gouldi*, which is presently listed as vulnerable.

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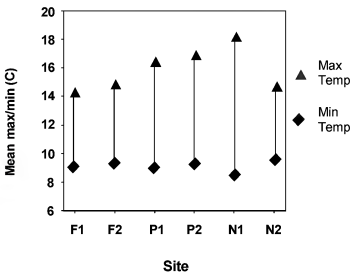

Figure 1

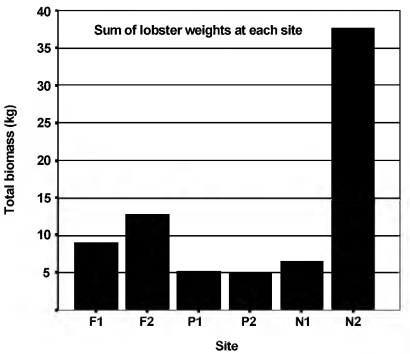

Figure 2

Historical footnote

Bridport, 94 years ago:

> *There are two little creeks in the near neighbourhood; the Brid, which flowed quite near the settler's house into the bay, and Muddy Creek a tiny rivulet about two miles to the east. In these two creeks we used to fish for Blackfish and for Crayfish, or Freshwater Lobsters as the settlers call them... Besides fishing with a line for Blackfish we used to lower lobster-pots, baited with raw meat, for the large freshwater Crayfishes* (Astacopsis Franklinii)*..., which inhabit the creeks and rivers of northern Tasmania. This Crayfish is the largest in the world, and is quite a distinct species from the small Crayfish which is found in the creeks of the southern part of the island, and which never grows to more than five or six inches in length. The northern Crayfish grows to nearly two feet in length, and may scale eight or nine pounds, competing in size with our marine Lobster; it is dark-green in colour, and studded on the claws and gill-covers with blunt tubercules; the claws of the larger specimens are formidable weapons about the size of a man's hand. We obtained the largest specimens from Muddy Creek, a small rivulet that one could easily step across, and it seemed extraordinary to fish these huge monsters out of little pools in which one would expect to find nothing larger than a minnow. All these Crayfishes were smothered with a parasitic Flat-worm (*Temnocephala*), about a quarter of an inch long, which were present in such numbers, as to appear like a green foam covering the animal. The freshwater Crayfish or Lobster is excellent to eat, being less coarse than the marine Crayfish (*Panulirus*), which is the chief commercial Crustacean of Australia; but owing to the difficulties of catching it, it never appears in the fish markets, and the only people who eat it, or know anything about it, are a few prospectors and bushmen.*

pp. 108-110 *in* Smith, G. (1909)
A Naturalist in Tasmania.
Oxford: Clarendon Press

English zoologist Geoffrey Smith spent the summer of 1907/08 in Tasmania. At the time of Smith's visit all large Tasmanian freshwater crayfish were called *A. franklinii*. In 1936 *Astacopsis* was split by Ellen Clark into *A. franklinii* (West Coast and Southwest), *A. tricornis* (eastern Tasmania) and *A. gouldi* (north coast, the largest species).

Clark, E. 1936. The freshwater and land crayfishes of Australia. *Memoirs of the National Museum of Victoria* 10: 5-58.

Hamr, P. 1992. A revision of the Tasmanian freshwater crayfish genus *Astacopsis* Huxley (Decapoda: Parastacidae). *Papers and Proceedings of the Royal Society of Tasmania* 126: 91-94.

Beetles for bones

The QVM Zoology Department has over the years developed an extensive reference collection of vertebrate skeletal material. Cleaning these skeletons can be a very messy, time-consuming and often fiddly process, unless the 'zoology assistants' happen to be *Dermestes maculatus* (Coleoptera : Dermestidae).

For over 20 years, these nondescript little black beetles and their voracious larvae have been harnessed to clean all manner of vertebrate carcasses, from bats, small birds and snakes through to bits of whales. *Dermestes* require dried material to feed on and this is facilitated by removing the major muscle masses and organs from specimens before air-drying.

Beetle colonies are kept in 600 x 600 x 1200 mm stainless steel tanks, each closed with a close-fitting perspex lid. The bottom of each tank is covered by a layer of raw wool 80 -100 mm thick in which the beetles pupate. (When the tanks were cleaned two years ago, the bedding in each started out as three fresh sheep-skins from the local meatworks!)

Since the beetles prefer to work in low light conditions, the tank lids were covered with black plastic leaving only meshed ventilation holes. The adult beetles are ungainly fliers but they reach the ventilation mesh occasionally, necessitating three or four sharp raps on the lid to dislodge them before the tanks are opened.

The 'Beetle Room' is bare except for essential gear, and is painted white so that would-be escapees have nowhere to hide. Clinical the decor may be, but it also makes it easier to control the Cupboard Spider (*Steatoda livens*) which can be a predator of *Dermestes*.

Over five or six weeks, the larvae feed voraciously and grow to hairy behemoths of 15 mm in length before they pupate. We sometimes segregate the smaller, more delicate vertebrate specimens with a limited number of early instar larvae. Later instars *en masse* can quickly disarticulate a skeleton completely and scatter the bones, making them difficult to find amongst the frass and exuviae.

Colony activity is maintained year-round by keeping the 'Beetle Room' at a constant 24°C. Beyond this, the only control on beetle populations is food: the more they're fed, the more beetles there are. When specimens are few, a 'skeleton staff' can be easily maintained with dried lamb scraps or butcher's bones.

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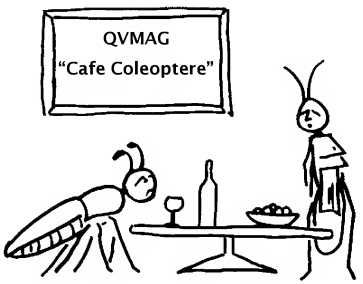

'I'm sorry, sir. Fox is currently unavailable.'

Forestry Tasmania and IBOY invertebrate projects

IBOY is the International Biodiversity Observation Year (actually it lasts for three years!). IBOY is an attempt to link international programs of research and provide baseline data to monitor future environmental changes within ecosystems. Forestry Tasmania has several projects linked to IBOY utilising the Warra Long Term Ecological Research site in southern Tasmania. Warra is a core site in Forest Ecosystems, a subset of IBOY projects. The IBOY projects are:

DIWPA-IBOY: Canopy Fogging

A contract with the Museum of Victoria, to provide equipment and expertise, has been finalised for a weeklong canopy fogging exercise at Warra. Several tree canopies within the major forest types will be fogged with a synthetic pyrethroid insecticide and the specimens collected in suspended canopy collectors. This exercise will provide a snapshot of the Spring invertebrate fauna inhabiting the upper foliage. Canopy fogging of rainforest (wet forest) trees will be conducted at 18 sites on a latitudinal transect from Japan to Tasmania during spring 2001.

GLIDE-IBOY: Litter decomposition

An international project conducted in 20 countries using identical protocols. The project will examine the impact of invertebrates on rates of litter decomposition using standard litterbags prepared by Colorado State University. The project will run for one year commencing July 2001.

MACROFAUNA-IBOY: Soil invertebrate communities

A project involving 21 countries examining soil invertebrate communities which impact on soil fertility. Management of these communities is now considered an efficient way to improve the sustainability of land utilisation. A standard protocol for invertebrate extraction from soil samples has been defined and the prepared specimens will be sent to France for processing. Sites will be sampled four times during the next twelve months.

ALTITUDINAL TRANSECT-IBOY: Altitudinal biodiversity

This project has been proposed to IBOY as a Tasmanian initiative. The Mt Weld/Warra altitudinal transects are being monitored by FT and DPIWE in a joint project to determine baseline invertebrate data for future environmental change surveys. Sampling using pitfall traps and malaise traps has commenced at each 100-metre altitude increment from 100 to 1300 m.

A poster display on this initiative will be presented at the Australian Entomological Society conference in Sydney. For more on IBOY, see **www.nrel.colostate.edu/IBOY**.

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Confessions of a serial sectioner

Brian Smith's recent coming out as a specialist suffering from character envy ('The grass is always greener', *Invertebrata* 19, March 2001) has given me the courage to also confess to this sub-set of one of the seven deadly sins.

I am one of those accursed wretches who, for unknown but evidently horrendous crimes in another life, has been given the genes which arouse my native curiosity in beasts with few external features – terrestrial flatworms. Being parenchymatous beasts, flatworms yield few characters on dissection; they must be histologically serially-sectioned. In taxonomic literature, the words 'histology' and 'laborious' are generally used together. This can be exemplified by 8μm serial sections of a 70 mm long specimen reduced to 140 microslides, a preparatory task which takes two or three days, with examination and reconstruction taking possibly some weeks to complete, especially in the in the present climate of multiskilled working.

Thus there are indeed times – mercifully few I might add – when I envy those taxonomists who can take the subjects of their interest, and simply view them whole under a lens, optical or scanning electron microscope, and at that level access all the characters necessary for classification. What I particularly envy is the relative ease with which some specialists can, amongst other things, readily assess the variability and reliability of characters for a given species, or confidently identify the species present in a particular sample.... in hours and days, rather than weeks or months.

Like many of Brian's molluscs, flatworms have few reliable external features, and even fewer in contracted, preserved specimens. Eye pattern and the positions of body apertures are valuable. Useful but subtle characters in the living animal such as transverse body shape are generally lost in the preserved specimen. Colour and pattern of markings can be extremely variable, and are only reliable in a handful of species. Specimens with the same external markings can, on serial sectioning and reconstruction of their microanatomy, turn out to belong to different genera or species. Conversely, specimens exhibiting widely disparate markings may be the same species in different guises. Tasmanian terrestrial flatworms in particular are good at doing these things.

Only some 20% of the 90 described species of Australian terrestrial flatworms, in a fauna estimated at some 300 species, are presently known anatomically. The challenge of elucidating and describing the microanatomy and the functional histology of these taxa has its frustrations, such as reconstructing often complex copulatory organs, but overall it is very interesting and exciting work. Compensation for serial sectioners like myself is as described by the medical microbiologist Robert Desowitz : '*...each time I turn on the microscope lamp, I still feel, like Leeuwenhoek did, like a voyager embarking on a journey to a distant and exotic land.*'

Character envy? Yes, sometimes. Bored? Never.

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Recent spider crab aggregations

Since July 1999, when an article on spider crabs was published by Caleb Gardner in *Invertebrata,* there have been many reports of aggregations and sometimes strandings of the crab *Leptomithrax gaimardii* (M-Ed.) around Tasmania. Each late autumn to winter the crabs have been arriving in seemingly predictable locations to mate and to moult. Repeated sightings have been made along the northwest coast, at Dunalley, all through the River Derwent Estuary and the D'Entrecasteaux Channel. Other reports have come from Swansea and the Freycinet. The species is also found all around the southern Australian coastline. In the River Derwent they frequently aggregate off the suburban shores of Hobart, and right up into the city at Watermans Dock, a stone's (crab's?) throw from Parliament House!

In autumn 2001, the Royal Yacht Club of Tasmania in Sandy Bay, Hobart, had to call in divers to remove ten-deep crabs from the rails of their slips before a boat could traverse them.

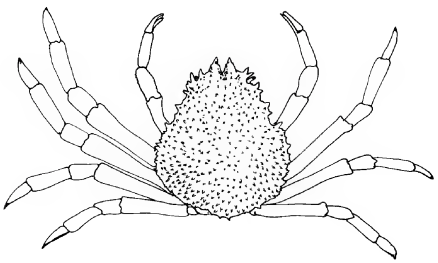
The crabs are large and may have a carapace span of 120 mm. They occur seasonally from shallow water to over 800 m in depth, and are white and orange in colour. The males have larger front claws than the females. The carapace is very hard and prickly and the best way to pick them up, if you must, is from the rear, though a well-endowed male can still reach your fingers (personal experience).

The crabs graze on algae and prefer shallow, silty areas to moult and mate, and will form dense aggregations at these times. These events are quite common as *Leptomitrax gaimardii* is an abundant species around Tasmania's inshore coast. Aggregations, sometimes a metre high and many metres wide, are a natural process and may occur for several reasons.

When the females are soft-shelled after moulting they become sexually receptive to mating. This may attract males in large numbers. Sometimes mounds of crabs may all be moulting at the same time, and this may be a protection against predators. When a large aggregation of crabs occurs offshore, and the weather is blowing onshore, masses of crabs may be washed up on beaches and these events are called strandings. A close inspection may show that many of the 'crabs' are the empty cast-off shells. Between moults the carapace and often the legs as well can be covered with tube worm casts and algae. It must be a great relief for the crab to shed its tight shell and move about freely again.

The earliest account of *Leptomithrax gaimardii* in Tasmania was from Francois Péron's accounts of his journey around Tasmania in 1802, where he described aggregations as *'spider crabs, which delight in filth and mud, abounded to excess on every point in the* [D'Entrecasteaux] *Channel'* (Plomley *et al.* 1990). The Channel is still one of the most often reported areas for aggregations.

Although the crabs are reported to be good eating, there are regulations about taking living marine animals from the sea without a permit.



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Further information:

Gardner, C. 1999. Spider crab aggregation on Tasmania's northwest coast. *Invertebrata* 14.

Hale, H.M. 1927-29. The Crustaceans of South Australia. Adelaide: Government Printer, South Australia.

Plomley, B., Cornell, C. and Banks, M. 1990. Francois Péron's natural history of Maria Island, Tasmania. *Records of the Queen Victoria Museum* 99.

Historical footnote

[Sunday, 28 March 1886]

This afternoon I took Edith, Frank and Arnold for a walk in the bush on the other side of the [Don] *river. We were much amused by the spiders who make webs with a coiled up dead leaf in the centre for a house. They are round bodied with yellow spots on their back. Their webs seem much stronger than any I ever saw before.*

Text and sketch from Gardam, F. (ed.) 1987. *Immense Enjoyment. The illustrated journals and letters of William L. Wells 1884-1888. The life of an early Quaker family in Tasmania.* Devonport: Devon Historical Society.

Invertebrates in the media

Rare species nesting near Windsor Castle

Any entomologists on their way to or returning from Royal Ascot this week might care to investigate a rare species discovered in Windsor Great Park last week.

Nests of poisonous rusty red and black spiders, with a leg span of up to 9 cm, were discovered by British Telecom engineers laying underground cables.

A scientist says they may be a species thought extinct or a new species, and described it as 'an extremely exciting find.'

'The species is certainly venomous and the jaws are strong enough to penetrate the human skin,' said Graham Smith, a member of Project-ARK, which aims to preserve the endangered species.

'Who knows how long these spiders have been in the royal park because they live underground.'

'There could be literally thousands and thousands, and it would be no surprise if they are living underneath Windsor Castle itself.'

A British Telecom spokesman said: 'They're large and there's a lot of them. Our engineers were not attacked, but we have stopped work at the site until we know exactly what they are.'

Attempts to fumigate the spiders could be illegal if they are found to be a preserved species and would spread them further afield, Mr. Smith claimed.

BBC online news, Tuesday 16 June 2001
www.bbc.co.uk/londonlive/news/june/spiders_190601.shtml

(*Many thanks to Niall Doran for this item. – Ed.*)

Notice that even a 'Queen Menaced by Giant Spiders!' story is tempered these days by cautions that the spiders might be threatened and in need of conservation. The UK public, at least, are getting media messages like *bugs are interesting* and *biodiversity preservation is an environmental issue*, although the headline might have been designed to lure the bird-fanciers.

And what about Australia? Any evidence that messages like those in the BBC story are getting through? It's hard to judge, but a report from the Community Biodiversity Network (Glanznig 2000) makes discouraging reading:

> *Australians still have a very low awareness of the term, biodiversity, and a poor understanding of the concept. A national AC Nielson phone poll undertaken in 1999 on behalf of Environment Australia found that while about 4 in 10 Australians thought they had heard of the term, only 1 in 10 understood the concept. The remainder thought the term was concerned with financial planning (buy-diversity) or alternative lifestyles (bi-diversity) (AC Nielson 1999). Recent focus group research suggests that most of those that understood the biodiversity concept had learnt about it through the school or university system (Consumer Contact 1998, p. 20).*
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> *This 1 in 10 awareness rate has remained static since the early 1990s when a major national quantitative study found that the term, 'biodiversity', remains virtually unknown (ANOP 1993). Additional social research undertaken in 1993 ascertained that where there is awareness, it tends to be associated with conservation. This qualitative study found that most participants thought that biodiversity was vaguely related to plants and animals, with a stronger association with animals. Insects and bacteria, either as species or as part of an ecosystem, was rarely raised, even after prompting (Michael Gill and Associates Pty Ltd 1993).*

A particularly hard message to get across is that invertebrates dominate every accepted measure of Australian biodiversity. They lead in species diversity, genetic diversity, community diversity, evolutionary potential, number of ecological interactions, etc. The 'Mortein'-wielding housewife might not like them, but Nature does. Australian biodiversity consists largely of bugs.

Biodiversity promoters know all about invertebrate dominance, but they're also aware that their audience has been culturally conditioned to abhor bugs. It's for this reason that Australian biodiversity posters typically feature frogs, birds and big-eyed little forest animals – which, ironically, are either constant or occasional predators on invertebrates.

The superbly illustrated magazine *Nature Australia*, published by the Australian Museum, regularly includes excellent articles on Australian invertebrates. It also has a page with 'thumbnails' of the front covers of back issues. Twenty-four front covers are shown in the autumn 2001 *Nature Australia*. The subject tally is birds 10, mammals 9 (including two with humans), frogs 2, lizards 1, fish 1 and dinosaurs 1. Two years ago we contacted the editor of *Nature Australia* to ask why the magazine did such a good job of promoting invertebrates in its pages and such a poor job on its cover. In reply, the editor said that the choice of a subject for the cover was a highly critical decision that makes or breaks sales. Experience shows that bugs don't sell.

A similar distortion of the reality of biodiversity can be seen on the widely distributed poster promoting Tasmania's threatened species. Invertebrates outnumber vertebrates two to one on the State list, but you wouldn't guess so from looking at the poster (q.v.).

The difficulties involved in promoting invertebrate biodiversity were very competently discussed in four papers published by Australian zoologists in 1999 (see references below). Various strategies have been suggested for getting more favourable stories on invertebrates in the major media. What seems clear is that linking *bugs are interesting* to *biodiversity preservation is an environmental issue* is not a particularly smart gambit in a country largely ignorant of biodiversity.

Further information:

Glanznig, A. 2000. *Australians' Current Awareness and Understanding of Biodiversity and the Issues Confronting its Conservation.* **http://nccnsw.org.au/member/cbn/projects/CommunicatorsCentre/Comm_Aust.html**.

Ponder, W. and Lunney, D., eds. 1999. *The Other 99%. The Conservation and Biodiversity of Invertebrates.* Mosman (NSW): Royal Zoological Society of New South Wales. *See:*

Horwitz, P., Recher, H. and Majer, J. Putting invertebrates on the agenda: political and bureaucratic challenges. (pp. 398-406)

Allen, T.J. Building pathways for marine invertebrate conservation. (pp. 407-412)

Smith, R. 'Bugging the media': TV broadcasting and the invertebrate agenda. (pp. 413-417)

White, T.D. Linking amateur and professional observers. (pp. 418-422)